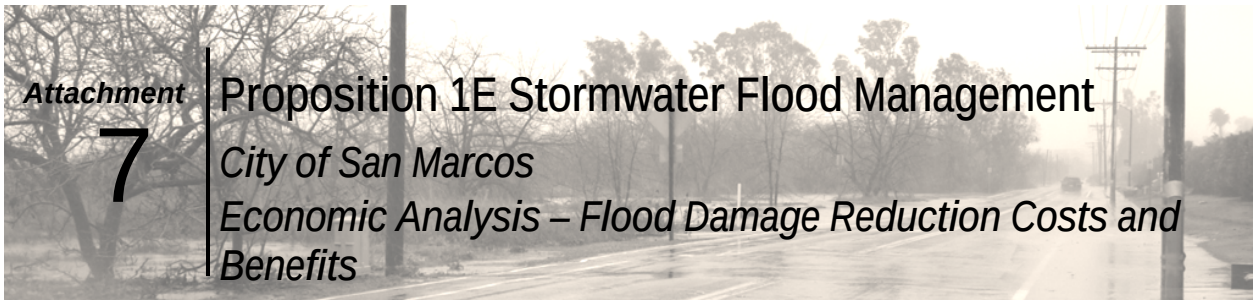

Attachment 7

Proposition 1E Stormwater Flood Management

City of San Marcos
Economic Analysis – Flood Damage Reduction Costs and Benefits

Attachment 7 consists of the following items:

- ✓ **Flood and Stormwater Background.** This attachment provides an overview of flood and stormwater management in the region and within the City of Marcos.
- ✓ **Project Costs.** The total costs associated with the project are presented.
- ✓ **Flood Damage Reduction Benefits.** The body of this attachment provides a description of the benefits of this proposed funding package with respect to potential flood damage reduction.

This attachment contains estimations of the flood damage reduction benefits, as well as the total costs associated with the *San Marcos Creek Floodway Improvement Project.* Section 1 provides a summary of the regional flood control background with respect to the San Diego IRWM Region as well as with respect to the Project Area. Section 2 contains a narrative description of the expected costs that would be incurred to implement and operate the project over the project's lifetime (through 2060). Section 3 contains a narrative description of the expected flood damage reduction benefits of the *San Marcos Creek Floodway Improvement Project*. Where possible, each benefit was quantified and presented in physical or economic terms. In cases where quantitative analyses were not feasible, this attachment provides complimentary qualitative analyses. In addition, this attachment provides a description of economic factors that may affect or qualify the amount of economic benefits to be realized. This attachment also includes a discussion regarding uncertainties about the future that might affect the level of benefit received

Flood and Stormwater Background

Flood Control

The San Diego County Flood Control District (Flood Control District) is the primary flood control agency in the County of San Diego. The Flood Control District (which is governed by the elected Supervisors of the County) establishes flood policies, maintains flood control facilities, operates a regional flood warning system, and is charged with protection of watercourses, watershed management, and protection of water quality. On a project-by-project basis, the Flood Control District coordinates flood control actions among the County's municipalities, federal and state agencies, watershed management groups, and flood control organizations in Orange and Riverside counties. Each municipality within the region is responsible for designing, constructing, and maintaining necessary flood control structures within its jurisdiction. As such, the City of San Marcos is responsible for flood control within the City limits.

Stormwater Management

The San Diego County MS4 Permit (Order No. R9-2007-0001), administered by the San Diego Regional Water Quality Control Board (RWQCB), regulates stormwater/urban runoff within the region. The County of San Diego acts as Principal Copermittee for the 21 Copermittees involved in this permit, which includes the City of San Marcos. Each Copermittee is responsible for operating its own stormwater/urban runoff management program within its respective jurisdiction. The Copermittees are responsible for managing storm water quality and helping to implement the TMDLs established by the San Diego RWQCB. The adopted San Diego IRWM Plan recognizes that it is important to protect surface and groundwater quality, which is reflected in Goal 2 of the IRWM Plan: *protect and enhance water quality.*

Under Order No. R9-2007-0001, San Diego RWQCB also regulates stormwater/urban runoff within the Upper San Marcos Creek area. In 2010, the Upper San Marcos Creek Watershed MS4 Copermittees (City of San Marcos, County of San Diego, and City of Escondido) developed the *Upper San Marcos Creek Nutrient Management Plan*, which established the following four objectives:

- Establish baseline data to assess nutrient-related water quality in the watershed and to measure future improvements;
- Identify potential sources of nutrients in the watershed and establish priorities for source control activities;
- Identify best management practices (BMPs) and other actions that will help to reduce nutrient discharges into and from municipal separate storm sewer systems (MS4s) operated by the Upper San Marcos Creek Watershed MS4 Copermittees;
- Establish a framework for collaboration among the Upper San Marcos Creek Watershed MS4 Copermittees, including, data collection, monitoring, outreach, and reporting.

In addition, the watershed discharges have established a stakeholder TMDL group that is overseen by the San Diego RWQCB. The objective of this group is to delist San Marcos Creek and Lake San Marcos from the 303(d) list for nutrients.

Project Costs

The following section provides information about all costs that will be incurred to implement, operate, and achieve benefits from the *San Marcos Creek Floodway Improvement Project* contained within this grant proposal. The summary of total project costs is based on Table 10 in DWR's Stormwater Flood Management Grant Proposal Solicitation Package (DWR 2010), inclusive of the project budget information contained in Attachment 4.

Tables 7-1 and 7-2 below provide summary budgets for this grant proposal, demonstrating that aside from project capital costs presented in Attachment 4, the proposed project will require additional capital and maintenance costs to fully achieve the project benefits.

Table 7-1: Total Project Costs

Phase	Timeline	Cost
San Marcos Creek Floodway Improvement Project Capital Costs – Floodwall, Channel Grading, and Restoration / Mitigation	2011 – 2014	$12,158,258
Future Capital Costs – Levee and Pad	2015 – 2016	$4,000,000
Operational Costs	2015 – 2060	$276,000
Total Project Costs		**$16,434,258**
Total Present Value of Discounted Costs (in 2009 dollars)		**$12,744,409**

Note: Please see Table 7-2 for additional detail on calculation of present value.

Table 7-2 demonstrates that the initial costs of the project, which sums to $12,158,258, will be allocated from 2011 to 2014, with the majority of funding being spent in 2012 and 2013. This initial cost total is equivalent to that presented within the Budget (Attachment 4) and is consistent with the Schedule (Attachment 5) of this grant proposal. Table 7-2 also demonstrates that maintenance efforts for this project are anticipated to be $6,000 per year following project construction in 2014, and continuing throughout the lifetime of the project (until 2060). These maintenance costs represent annual costs to maintain the trail and embankment slope behind the proposed floodwall (refer to Attachment 3 for more information). This estimate is based on approximately one week of work for a crew of three persons, and the use of one piece of grading equipment. In addition, the total costs contain additional capital costs not listed within the budget that will be necessary to purchase a levee and pad. These costs will sum $4,000,000, and will be incurred in 2015 and 2016.

Table 7-2: Annual Project Costs

Table 10 - Annual Cost of Flood Damage Reduction Project (All costs in 2009 dollars)									
	Initial Costs	Operations and Maintenance Costs						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Year	Total Project Cost	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a)+…+(f)	Discount Factor	Discounted Costs (g) x (h)
2009	$0	$0	$0	$0	$0	$0	$0	1.000	$0
2010	$0	$0	$0	$0	$0	$0	$0	0.943	$0
2011	$2,055,422	$0	$0	$0	$0	$0	$2,055,422	0.890	$1,829,319
2012	$4,052,753	$0	$0	$0	$0	$0	$4,052,753	0.840	$3,402,769
2013	$4,052,753	$0	$0	$0	$0	$0	$4,052,753	0.792	$3,210,160
2014	$1,997,330	$0	$0	$0	$0	$0	$1,997,330	0.747	$1,492,521
2015	$0	$0	$0	$6,000	$0	$2,000,000	$2,006,000	0.705	$1,414,151
2016	$0	$0	$0	$6,000	$0	$2,000,000	$2,006,000	0.665	$1,334,105
2017	$0	$0	$0	$6,000	$0	$0	$6,000	0.627	$3,764
2018	$0	$0	$0	$6,000	$0	$0	$6,000	0.592	$3,551
2019	$0	$0	$0	$6,000	$0	$0	$6,000	0.558	$3,350
2020	$0	$0	$0	$6,000	$0	$0	$6,000	0.527	$3,161
2021	$0	$0	$0	$6,000	$0	$0	$6,000	0.497	$2,982
2022	$0	$0	$0	$6,000	$0	$0	$6,000	0.469	$2,813
2023	$0	$0	$0	$6,000	$0	$0	$6,000	0.442	$2,654
2024	$0	$0	$0	$6,000	$0	$0	$6,000	0.417	$2,504
2025	$0	$0	$0	$6,000	$0	$0	$6,000	0.394	$2,362
2026	$0	$0	$0	$6,000	$0	$0	$6,000	0.371	$2,228
2027	$0	$0	$0	$6,000	$0	$0	$6,000	0.350	$2,102
2028	$0	$0	$0	$6,000	$0	$0	$6,000	0.331	$1,983
2029	$0	$0	$0	$6,000	$0	$0	$6,000	0.312	$1,871
2030	$0	$0	$0	$6,000	$0	$0	$6,000	0.294	$1,765
2031	$0	$0	$0	$6,000	$0	$0	$6,000	0.278	$1,665
2032	$0	$0	$0	$6,000	$0	$0	$6,000	0.262	$1,571
2033	$0	$0	$0	$6,000	$0	$0	$6,000	0.247	$1,482
2034	$0	$0	$0	$6,000	$0	$0	$6,000	0.233	$1,398
2035	$0	$0	$0	$6,000	$0	$0	$6,000	0.220	$1,319
2036	$0	$0	$0	$6,000	$0	$0	$6,000	0.207	$1,244
2037	$0	$0	$0	$6,000	$0	$0	$6,000	0.196	$1,174
2038	$0	$0	$0	$6,000	$0	$0	$6,000	0.185	$1,107
2039	$0	$0	$0	$6,000	$0	$0	$6,000	0.174	$1,045
2040	$0	$0	$0	$6,000	$0	$0	$6,000	0.164	$986
2041	$0	$0	$0	$6,000	$0	$0	$6,000	0.155	$930
2042	$0	$0	$0	$6,000	$0	$0	$6,000	0.146	$877
2043	$0	$0	$0	$6,000	$0	$0	$6,000	0.138	$827
2044	$0	$0	$0	$6,000	$0	$0	$6,000	0.130	$781
2045	$0	$0	$0	$6,000	$0	$0	$6,000	0.123	$736
2046	$0	$0	$0	$6,000	$0	$0	$6,000	0.116	$695
2047	$0	$0	$0	$6,000	$0	$0	$6,000	0.109	$655
2048	$0	$0	$0	$6,000	$0	$0	$6,000	0.103	$618
2049	$0	$0	$0	$6,000	$0	$0	$6,000	0.097	$583
2050	$0	$0	$0	$6,000	$0	$0	$6,000	0.092	$550
2051	$0	$0	$0	$6,000	$0	$0	$6,000	0.087	$519
2052	$0	$0	$0	$6,000	$0	$0	$6,000	0.082	$490
2053	$0	$0	$0	$6,000	$0	$0	$6,000	0.077	$462

Table 10 - Annual Cost of Flood Damage Reduction Project (All costs in 2009 dollars)									
	Initial Costs	Operations and Maintenance Costs						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Year	Total Project Cost	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a)+…+(f)	Discount Factor	Discounted Costs (g) x (h)
2054	$0	$0	$0	$6,000	$0	$0	$6,000	0.073	$436
2055	$0	$0	$0	$6,000	$0	$0	$6,000	0.069	$411
2056	$0	$0	$0	$6,000	$0	$0	$6,000	0.065	$388
2057	$0	$0	$0	$6,000	$0	$0	$6,000	0.061	$366
2058	$0	$0	$0	$6,000	$0	$0	$6,000	0.058	$345
2059	$0	$0	$0	$6,000	$0	$0	$6,000	0.054	$326
2060	$0	$0	$0	$6,000	$0	$0	$6,000	0.051	$307
Project Life	**Total Present Value of Discounted Costs (Sum of Column (i))**								**$12,744,409**

Flood Damage Reduction Benefits

The flood damage reduction benefits that are anticipated to result from implementation of the *San Marcos Creek Flood Improvement Project* are summarized below in Table 7-3, and the cost-benefit overview is summarized in Table 7-4. This project would result in monetized benefits due to avoided flood damages. Detailed cost and benefit information associated with the project, including present value calculations, is provided in Table 7-2.

Table 7-3: Benefits Summary

Type of Benefit	Assessment Level	Beneficiaries
Flood Damage Reduction Benefits		
Avoided Flood Damages	Monetized	Local

Table 7-4: Benefit-Cost Analysis Overview

	Present Value ($2009)
Costs – Total Capital and O&M	$12,744,409
Monetizable Benefits	
Avoided Flood Damages	$11,004,625
Qualitative Benefits	**Qualitative Indicator***
N/A	N/A

The "Without Project" Baseline

Existing conditions (without project) are those analyzed within the 2007 Environmental Impact Report conducted for the City of San Marcos on the San Marcos Creek Specific Plan (HDR 2007). This report demonstrated that the existing floodway and corresponding 100-year floodplain spanned throughout the downtown area of San Marcos, and would affect a multitude of residential and commercial developments.

Figure 7-1 below demonstrates the existing 100-Year floodway location within the project area as mapped by the Federal Emergency Management Agency (FEMA). Please note that while this is the existing 100-year floodplain that is currently mapped by FEMA, this was not used as the full without-project baseline for this economic analysis. The baseline floodplain for three flood events (10-year, 50-year, and 100-year), which were utilized as the baseline for this analysis are presented below in Figure 7-2.

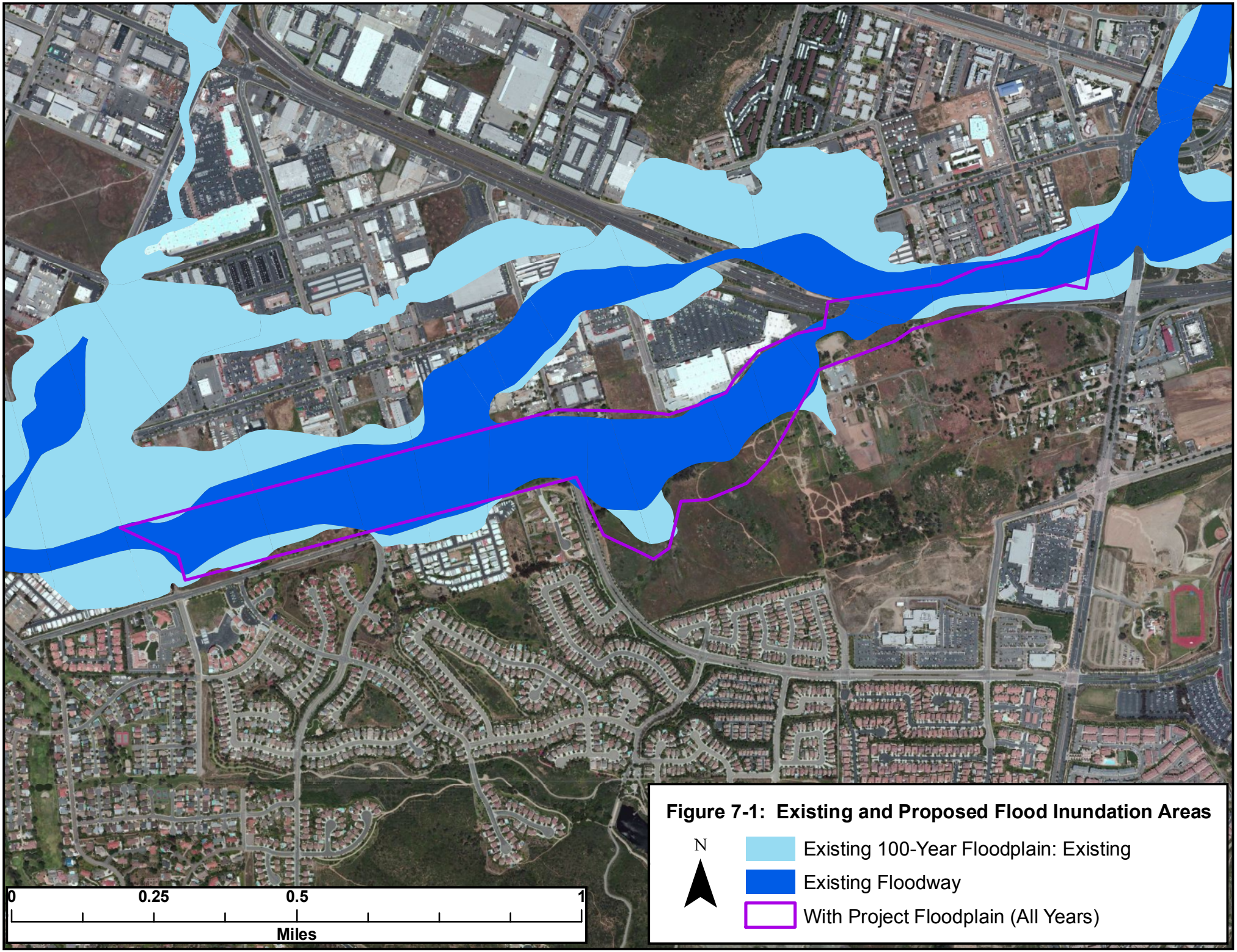

Figure 7-1: Existing and Proposed Flood Inundation Areas

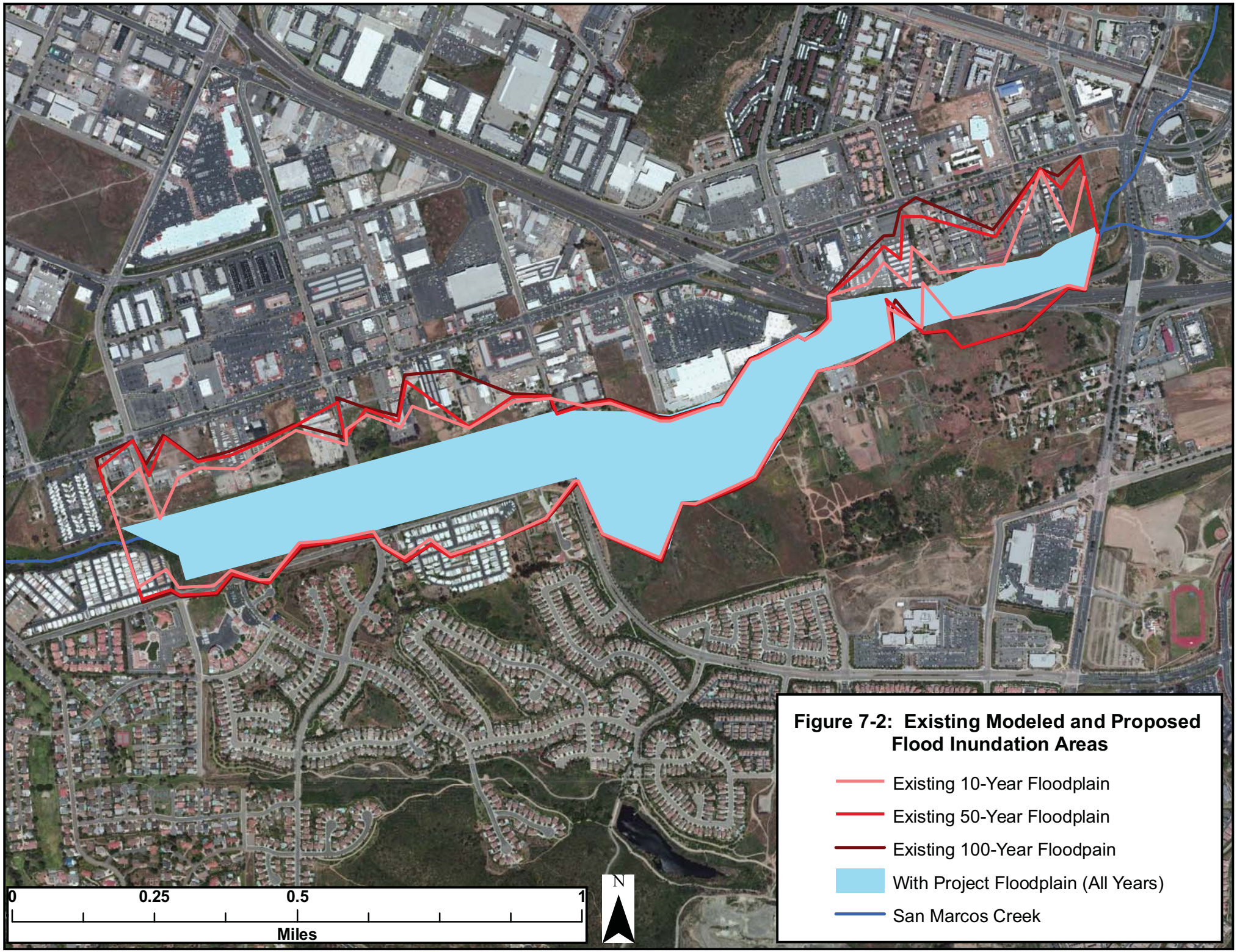
Figure 7-2: Existing Modeled and Proposed Flood Inundation Areas
Existing 10-Year Floodplain
Existing 50-Year Floodplain
Existing 100-Year Floodpain
With Project Floodplain (All Years)
San Marcos Creek
0
0.25
0.5
1
Miles
N

Benefits Analysis

Avoided Flood Damages

Roughly two-thirds of the project area is located within the 100-year floodplain. To alleviate the threat of flooding in the project area and to ensure public health and safety benefits, the San Marcos Creek Specific Plan identified the need for floodway improvements. The purpose of the *San Marcos Creek Floodway Improvement Project* is to reduce the severity of current 100-year storm flows such that they remain within the constraints of San Marcos Creek and the associated improved channel that will be constructed as part of this project. In turn, these flood improvements will serve to eliminate flooding of San Marcos Boulevard and adjacent surface streets, adjacent residences and businesses, and portions of State Route (SR) 78. The creek improvement portion of the project would include alterations of the creek through construction of a floodwall and other flood control measures.

The City of San Marcos contracted a Certified General Real Estate Appraiser in 2007 to complete an inventory of structures that would be protected from the FEMA 100-year floodplain of San Marcos Creek by the construction of the *San Marcos Creek Floodway Improvement Project.* This inventory demonstrated that the project would protect 101 properties with over 300 individual structures totaling more than 1,000,000 square feet and with an assessed value of $78,151,080 (Keagy Real Estate 2007).

For purposes of this grant proposal, additional economic benefit research was conducted using hydraulic modeling along with the Flood Rapid Assessment Model (FRAM) developed for DWR, and the Benefit Cost Analysis software developed by FEMA.

In 2006, the *San Marcos Creek Hydrologic and Hydraulic Report* was completed for the City of San Marcos. This report analyzed channel improvements that would be necessary to contain flows from FEMA 100-year and other flood events within San Marcos Creek (Parsons Brinckerhoff 2006). This analysis included modeling efforts that utilized the Hydrologic Engineering Centers River Analysis System (HEC-RAS) model to estimate with and without project flood inundation areas for three flood events: 10-year, 50-year, and 100-year. The spatial data associated with these modeling efforts is presented in Figure 7-2. As demonstrated within Figure 7-2, implementation of the *San Marcos Creek Floodway Improvement Project* would reduce flooding to the same level (contained within the San Marcos Creek floodway) for all three proposed flood events. The same is not true for existing conditions, which would generate various levels of flood inundation areas for 10-year, 50-year, and 100-year storm events.

The economic information that was input into FRAM, along with flood inundation data associated with Figure 7-2, was determined from the National Flood Insurance Program (NFIP). NFIP states that over the past ten years, the average flood claim has amounted to over $33,000 (NFIP 2011). For purposes of this analysis, it was assumed that each structure that would be impacted would have an average claim of $33,000. The Environmental Impact Report for the San Marcos Creek Specific Plan indicates that the downtown area of San Marcos (project area) is anticipated to include residential, commercial, and mixed use development. Due to the variety of anticipated uses within the Project Area, the average value of $33,000 for all claims (commercial and residential) was used.

Data from Figure 7-2 indicates that with a 10-year storm event, there would be damage to 126 structures, 0.5 miles of arterial roads, 2 miles of major roads, and 0.5 miles of minor roads. With a 50-year storm event, there would be damage to 179 structures, 0.5 miles of arterial roads, 2 miles of major roads, and 0.5 miles of minor roads. With a 100-year storm event there would be damage to 182 structures, 0.75 miles of arterial roads, 2.5 miles of major roads, and 1.3 miles of minor roads. Table 7-5 provides a summary of the FRAM model inputs.

Table 7-5: Summary of Modeled Flood Damage

	Without Project Event 1: 10-Year Storm Event	Without Project Event 2: 50-Year Storm Event	Without Project Event 3: 100-Year Storm Event
Buildings			
Total Structures Damaged	126	179	182
Roads			
Length of arterial (miles)	0.5	0.5	0.75
Length of major (miles)	2	2	2.5
Length of minor (miles)	0.5	0.75	1.3
	With Project Event 1: 10-Year Storm Event	**With Project Event 2: 50-Year Storm Event**	**With Project Event 3: 100-Year Storm Event**
Buildings			
Total Structures Damaged	0	0	0
Roads			
Length of arterial (miles)	0	0	0
Length of major (miles)	0	0	0
Length of minor (miles)	0	0	0

Utilizing this information, the calculation of $33,000 damage per structure, and value calculations for road damage from the FRAM model, the total expected annual damage from flood events without implementation of the project would be $698,263.

As per requirements set forth by DWR, this project is assumed to have a 50-year lifetime. Therefore, the present value coefficient utilized for these calculations was 15.76, which assumes a 50-year benefit period. The present value calculations related to anticipated flood damage benefits presented in Table 7-6 total approximately $11,004,625.

Table 7-6: Expected Annual Damage Benefits

Table 12 – Present Value of Expected Annual Damage Benefits			
(a)	Expected Annual Damage Without Project		$698,263
(b)	Expected Annual Damage With Project		$0
(c)	Expected Annual Damage Benefit	[a - b]	$698,263
(d)	Present Value Coefficent		15.76
(e)	**Present Value of Future Benefits**	**[c x d]**	**$11,004,625**

Distribution of Project Benefits and Identification of Beneficiaries

Table 7-7 summarizes the anticipated beneficiaries of flood damage reduction benefits that would be provided by the *San Marcos Creek Floodway Improvement Project.* The flood damage reduction benefits would benefit local residents within the floodplain adjacent to the project area (refer to Figure 7-1).

Table 7-7: Project Beneficiaries Summary

Local	Regional	Statewide
Local residents within the San Marcos Creek floodplain	Not Applicable	Not Applicable

Project Benefits Timeline Description

Flood reduction benefits would occur over the 50-year lifetime of the project and relative to the probability of various hydrologic events. Therefore, this project would accrue benefits due to 10-year, 50-year, and 100-year flood events.

Potential Adverse Effects from the Project

Any potential short-term construction-related impacts associated with this project will be addressed and mitigated during the environmental documentation and permitting processes. No long-term adverse effects are expected as a result of this project.

Uncertainty of Benefits

Uncertainties relating to the flood reduction benefits of this project are summarized below in Table 7-8. As shown in the table below, uncertainties regarding flood reduction benefits would occur because additional detailed flood modeling would demonstrate the full benefits of this project.

Table 7-8: Omissions, Biases, and Uncertainties and their Effect on the Project

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Avoided Flood Damages	+	Analysis utilized as part of this project, including the 10-year, 50-year, and 100-year flood zones were notably conservative. Figure 7-1 demonstrates that the potential 100-year flood zone is potentially much more extensive than calculated within this assessment. Further flood modeling could potentially find a moderate positive benefit both structures and roads.

* Magnitude of effect on net benefits
+/- (negligible or unknown); + (moderate positive); ++ (significant positive); - (moderate negative); -- (significant negative)

References

HDR Engineering, Inc. (HDR). 2007. *Final Environmental Impact Report for the San Marcos Creek Specific Plan and Floodway Improvement Project.* Prepared for the City of San Marcos. June 2007.

Keagy Real Estate. 2007. *Inventory of Structures to be Protected by San Marcos Creek Flood Improvement Project.* Prepared for the City of San Marcos by Keagy Real Estate: Real Estate Appraisal and Consultation.

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Parsons Brinckerhoff. 2006. *Hydrologic and Hydraulic Report for San Marcos Creek Improvement* Prepared for the City of San Marcos by Parsons Brinckerhoff.